

Observed Intra-seasonal Variability Of Lower Tropospheric Water Vapor in Eastern Pacific from AIRS

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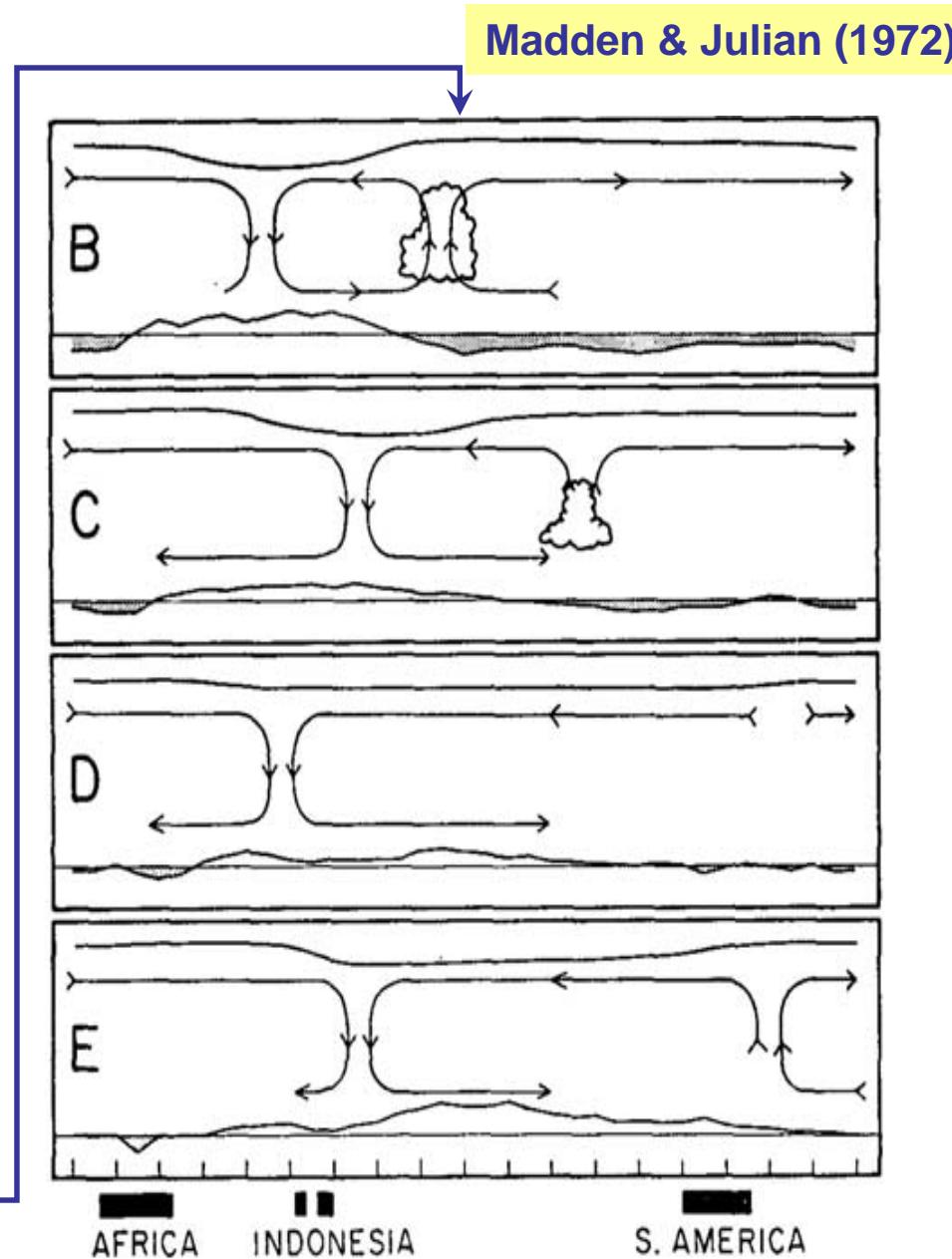
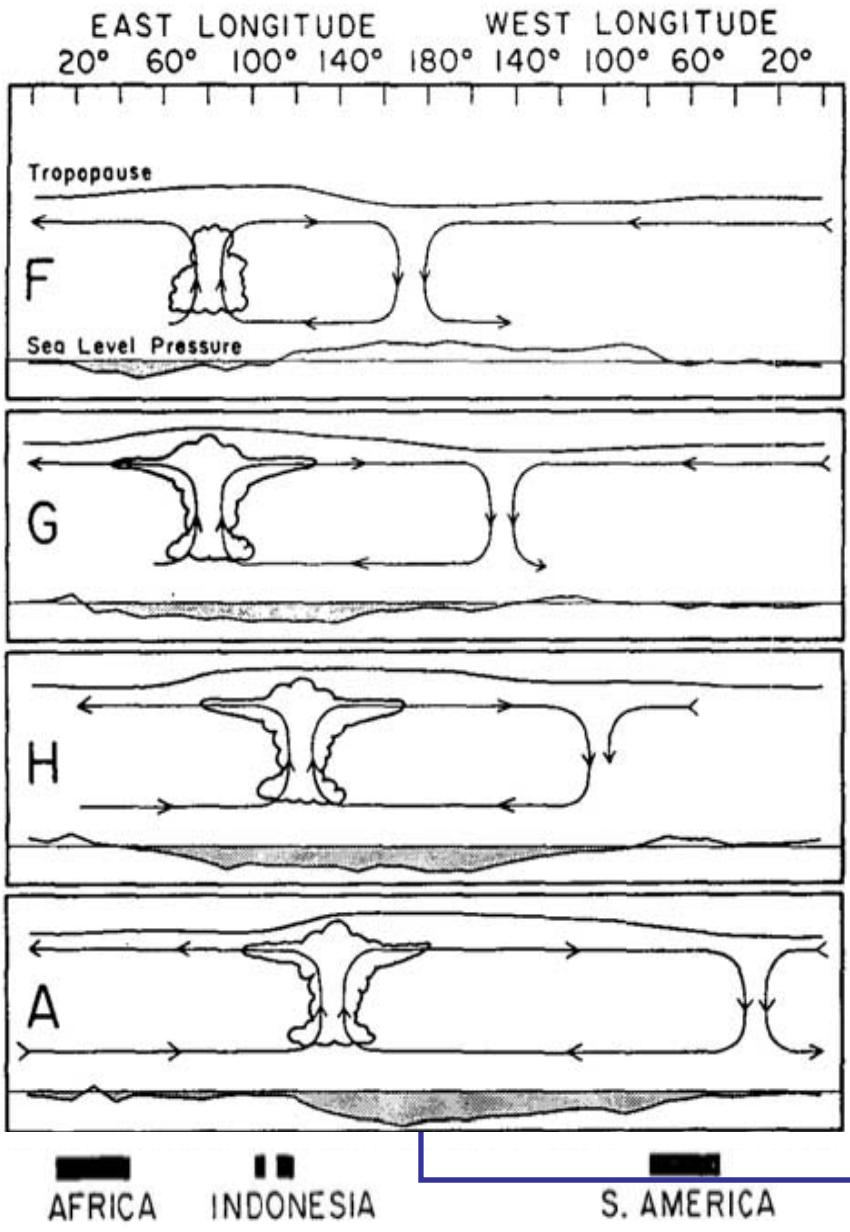
Baijun Tian, Duane E Waliser
Jet Propulsion Laboratory

Presented in AIRS Science Team Meeting (April, 2010)

Objective

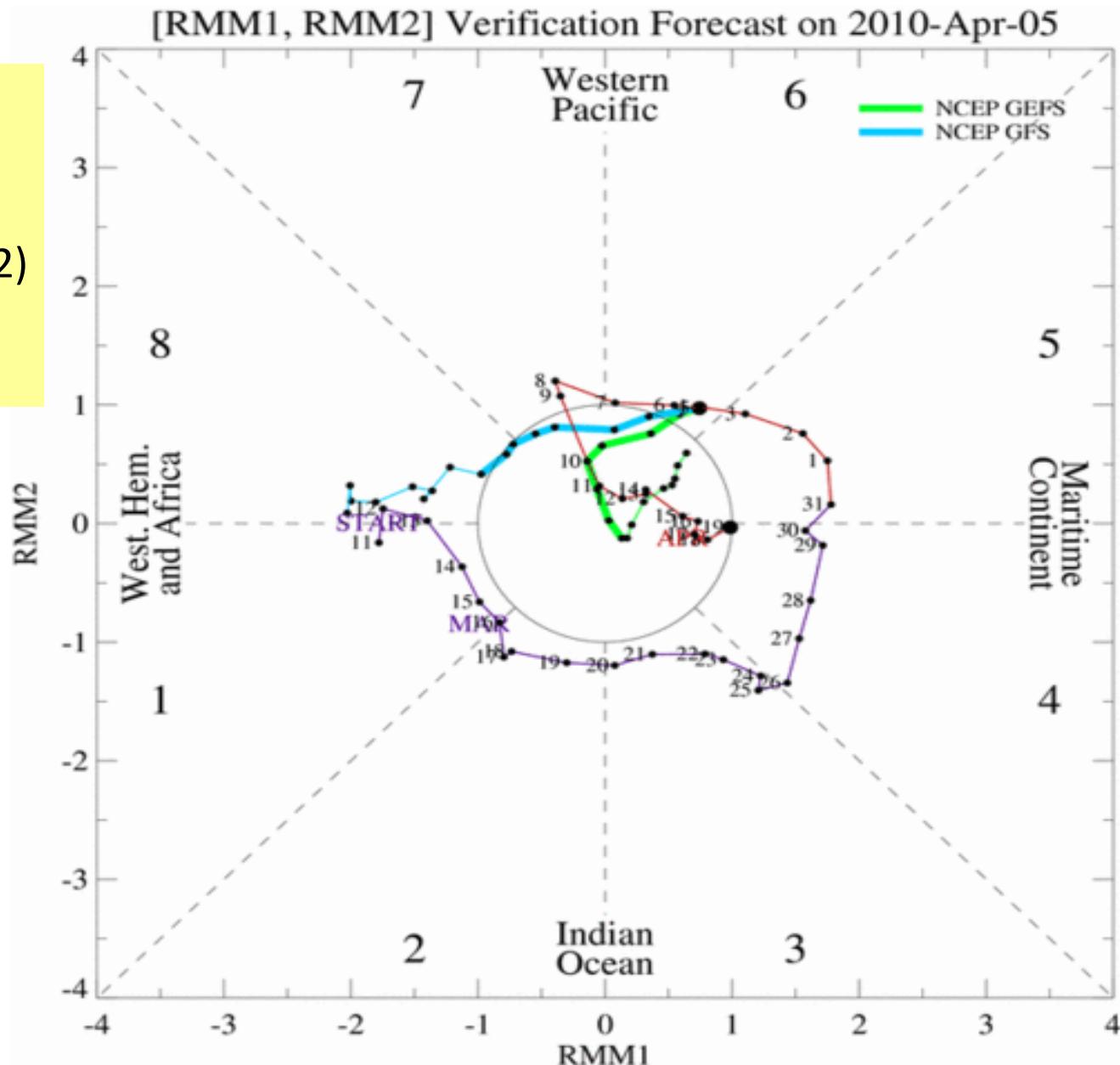
- Tian et al. (2006) observed large intra-seasonal variability in AIRS H₂O over E Pacific that is as strong as those in Indian Ocean and W Pacific
- To understand what is responsible for the large intra-seasonal variability of H₂O over the E. Pacific

Madden-Julian Oscillation (MJO): Basics

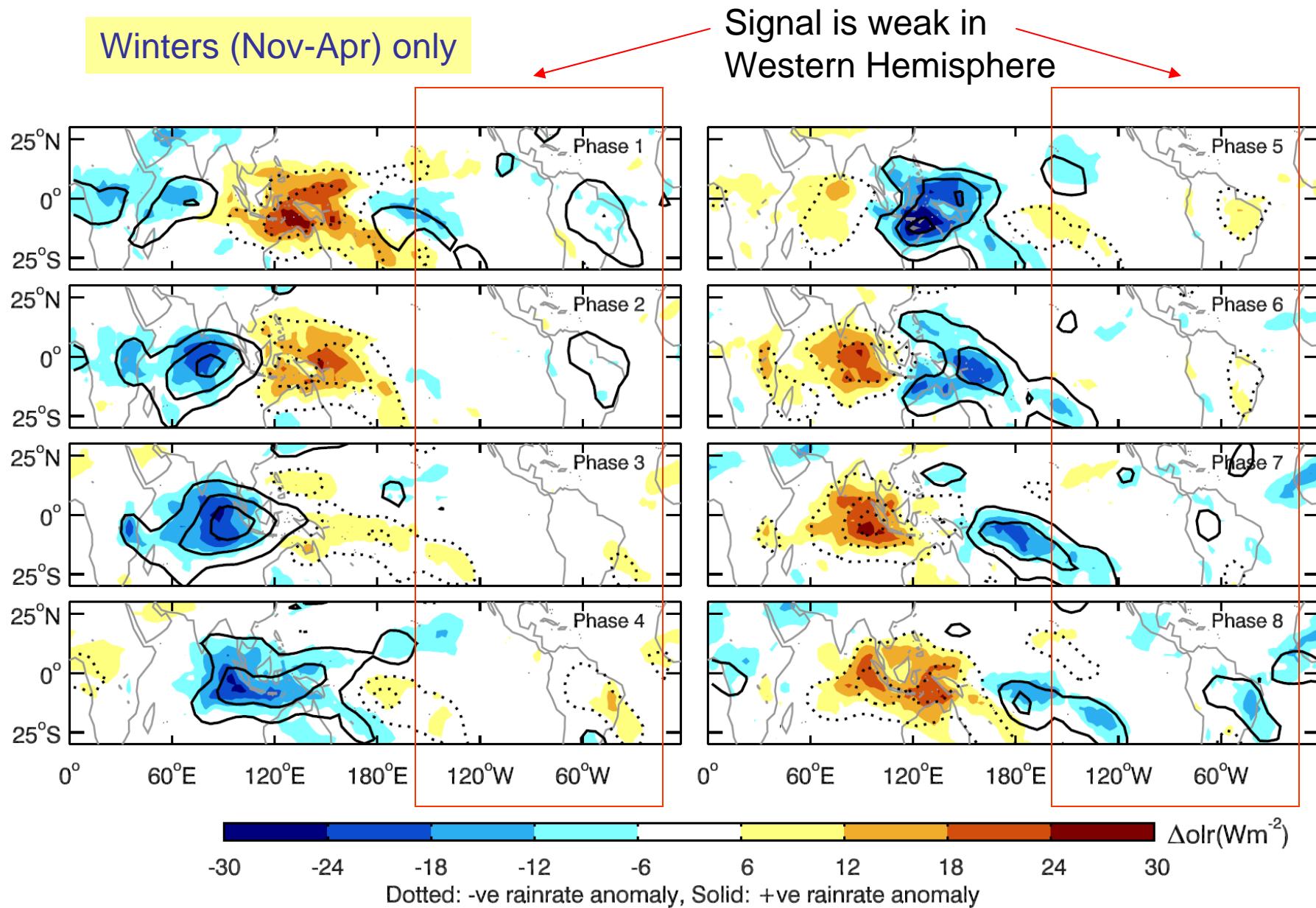


MJO (Wheeler-Hendon) Indices

Each day is assigned with two indices RMM1 and RMM2. The pair (RMM1,RMM2) characterizes the MJO phase number



MJO Observations: OLR + TRMM Rainfall

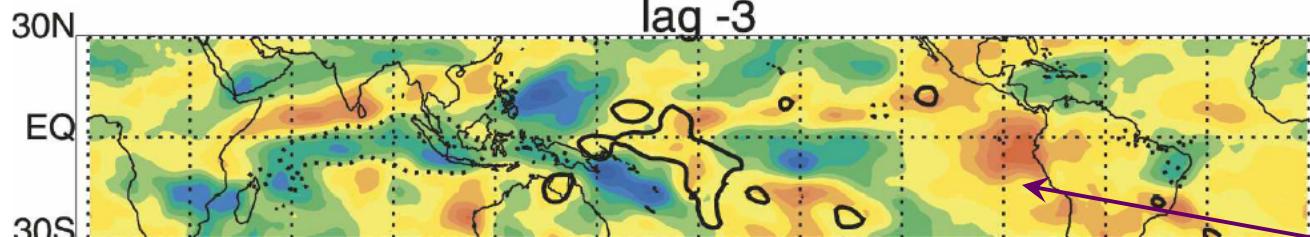


MJO in AIRS H₂O (Lower Atmosphere)

B. Tian et al. (2006)

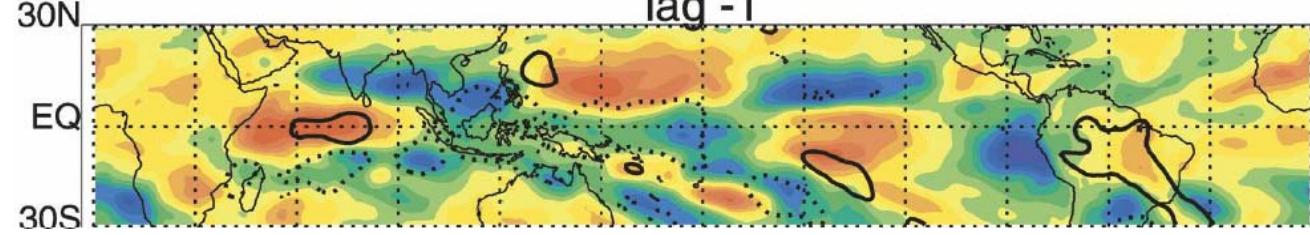
EEOF (Each Lag = 5-6 days)

lag -3

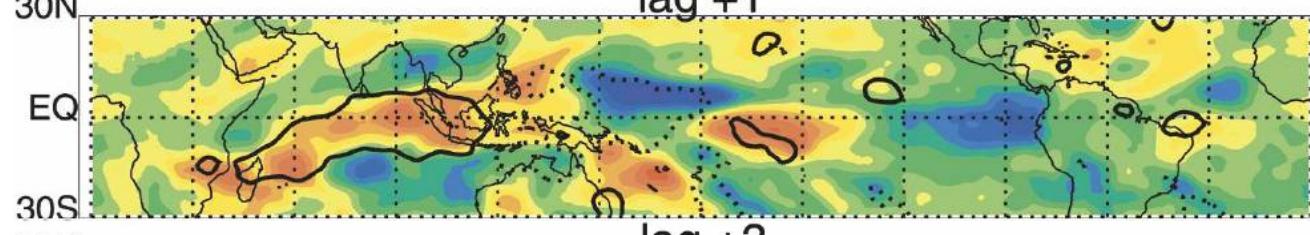


Variations comparable to Indian Ocean and W Pacific

lag -1

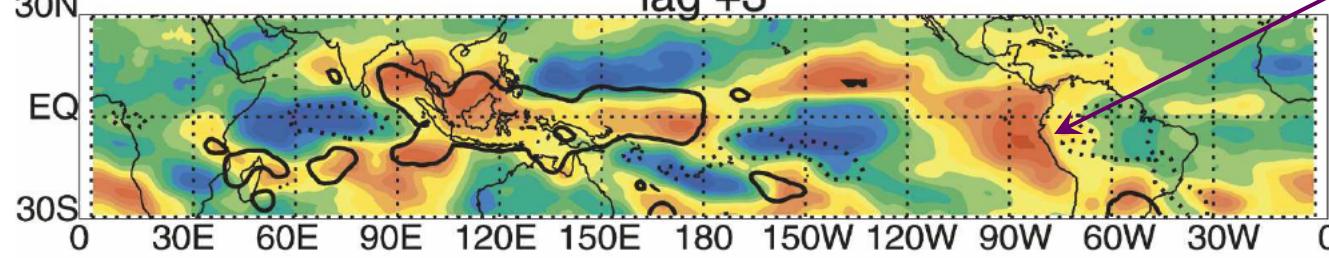


lag +1

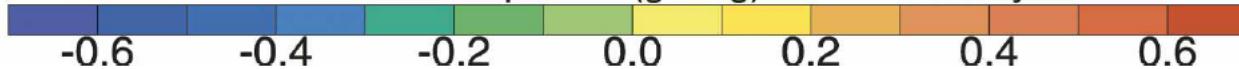


Topographic effects

lag +3

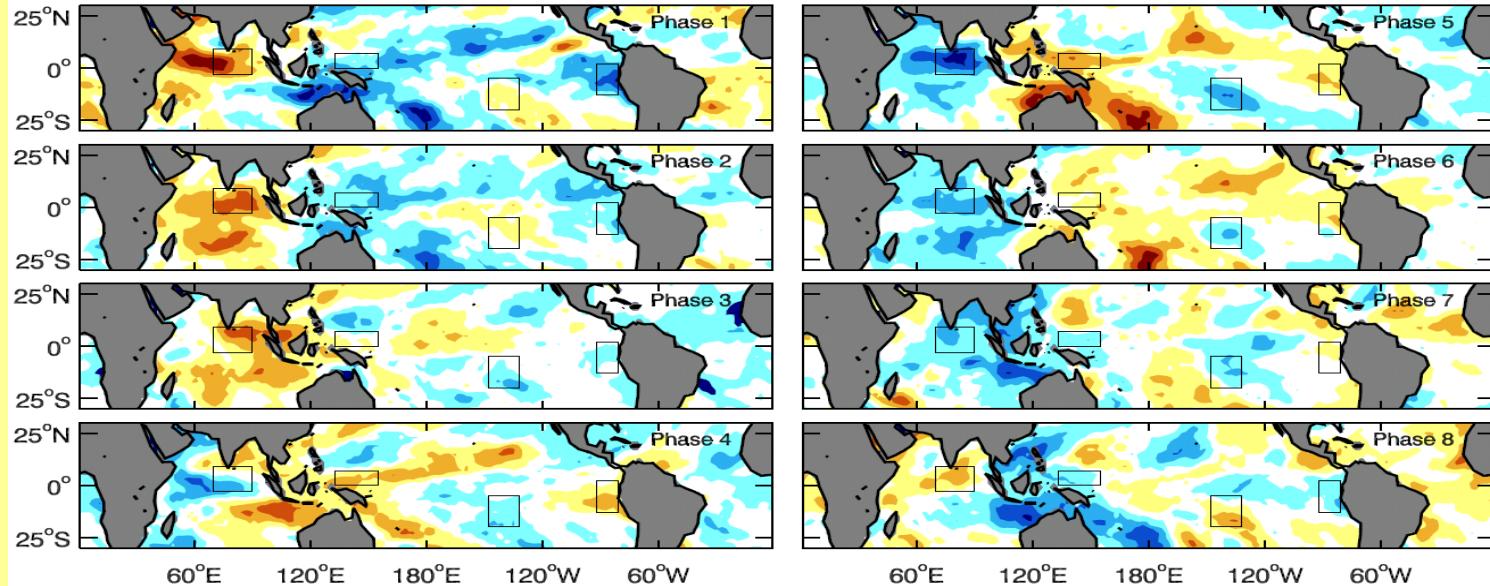


648mb H₂O Vap MMR (gm/kg) MJO Anomaly (Solid: +ve Rainfall anomaly)

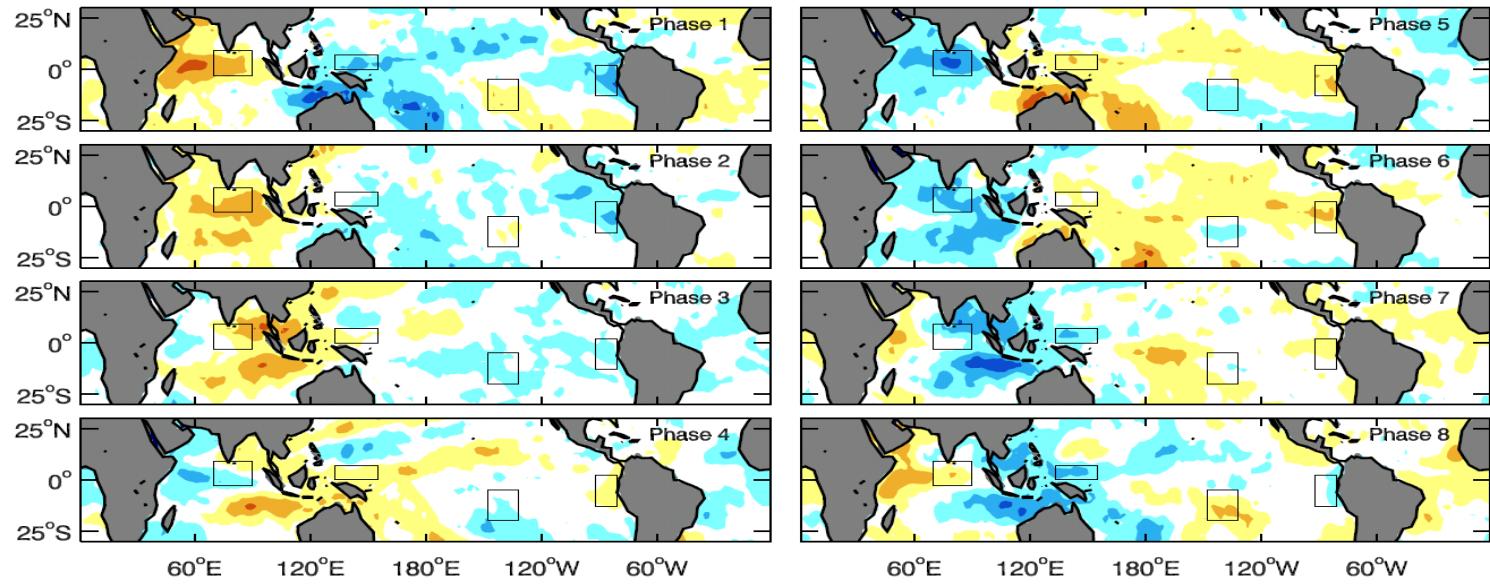


Further evidence from column data

TMI



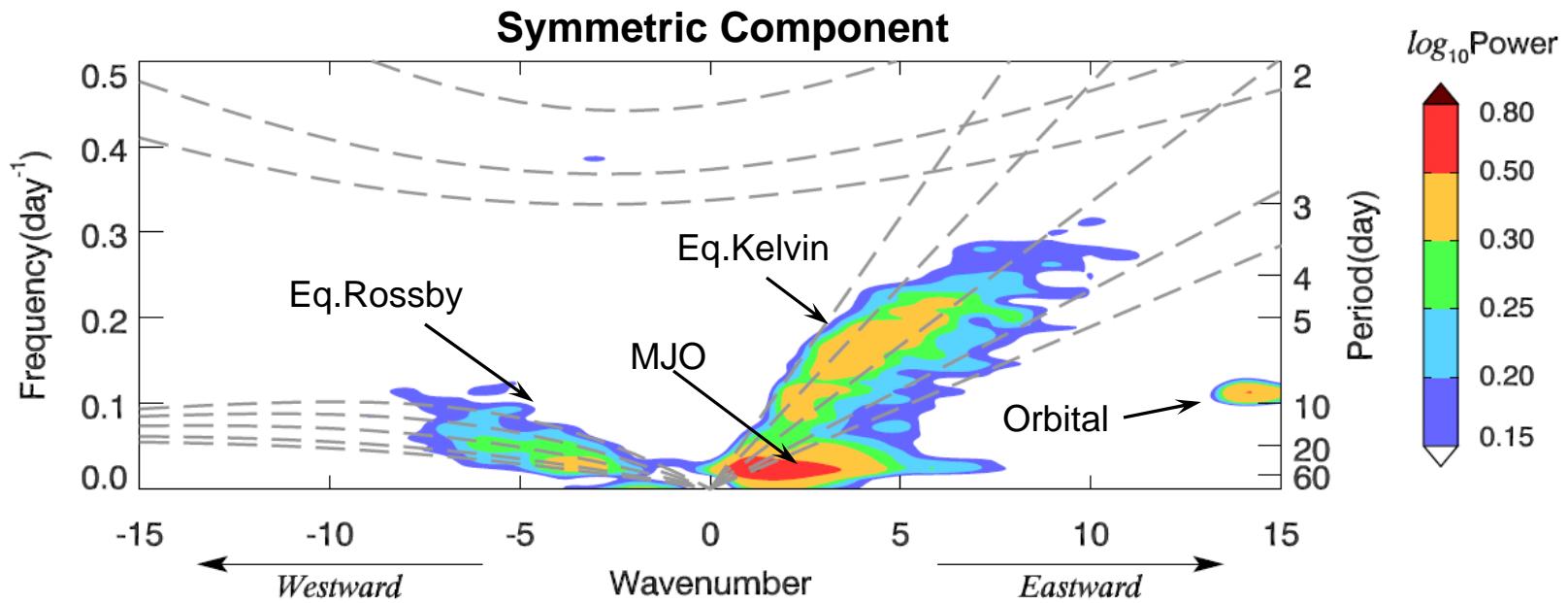
SSM/I



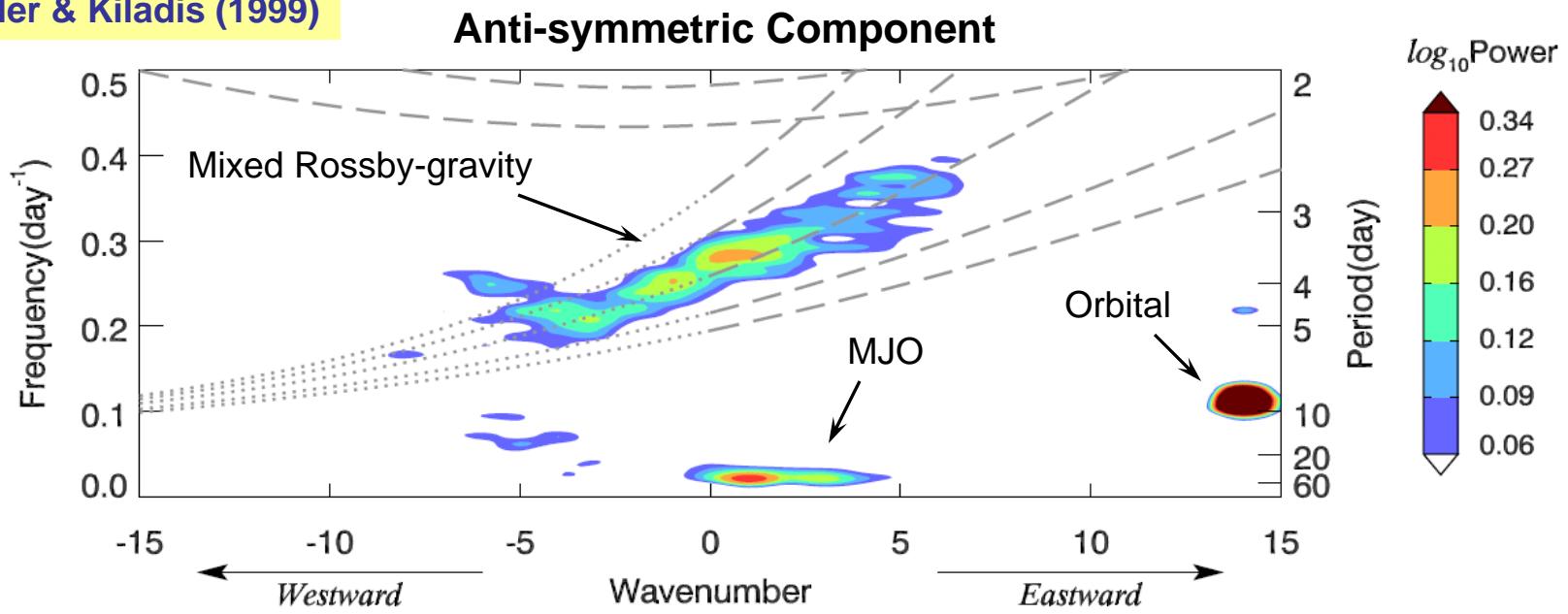
Methodology

- Compare 2D Space-Time Spectra from OLR and AIRS H₂O
 - Reveal free waves in the data
 - Quantify relative contributions of the wave components

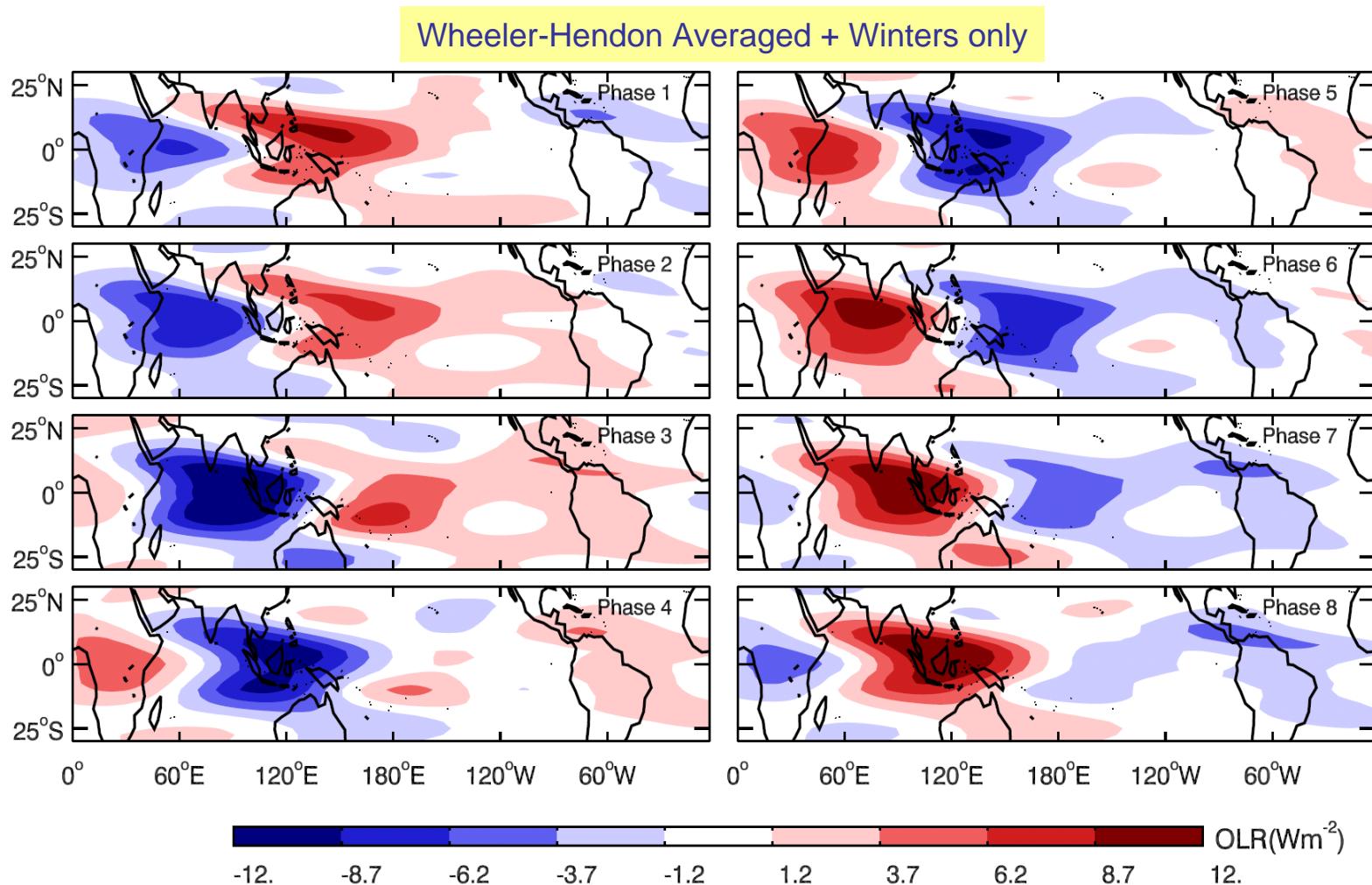
Spectral Analysis: OLR



Wheeler & Kiladis (1999)

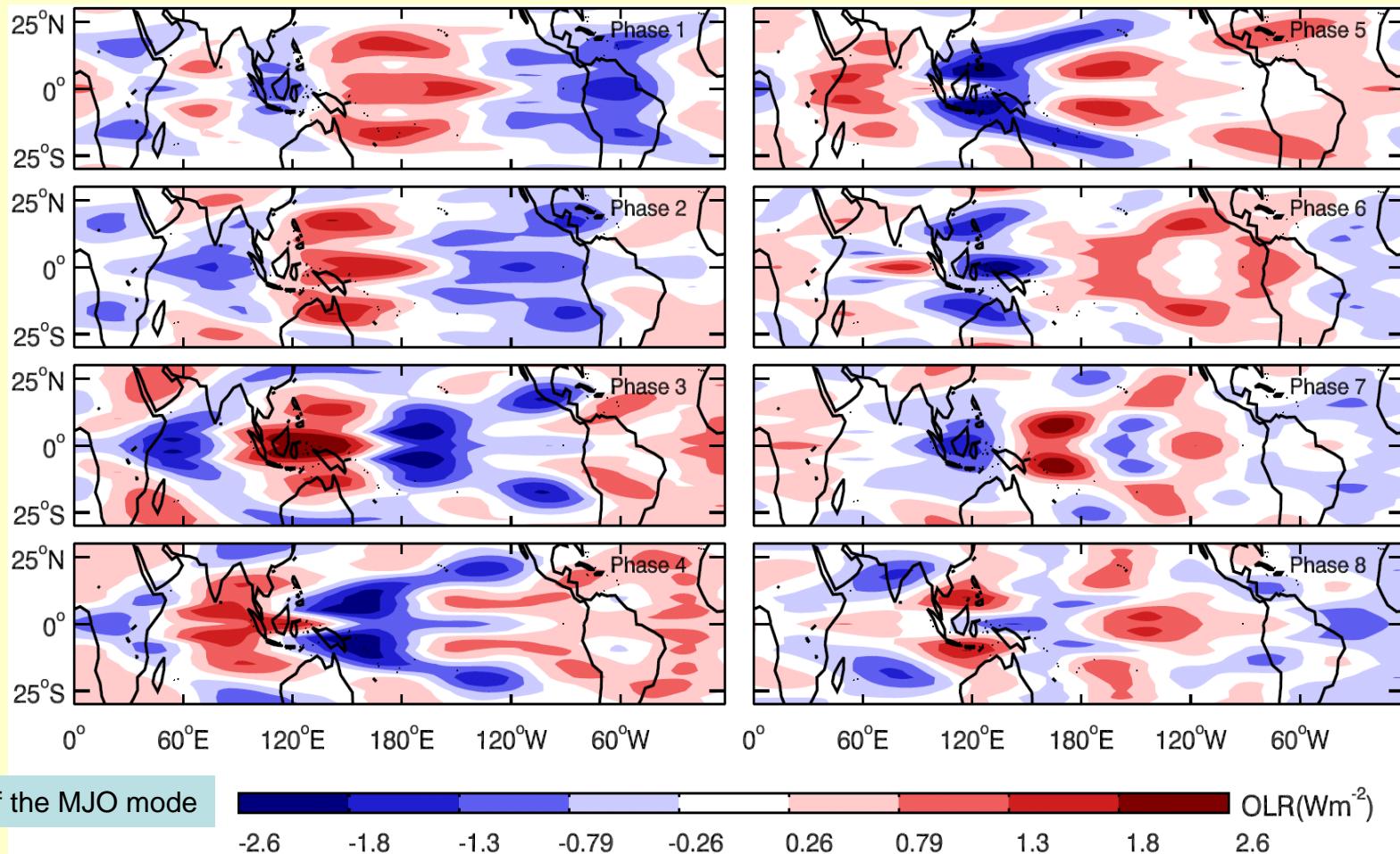


Mode Filtering: MJO mode

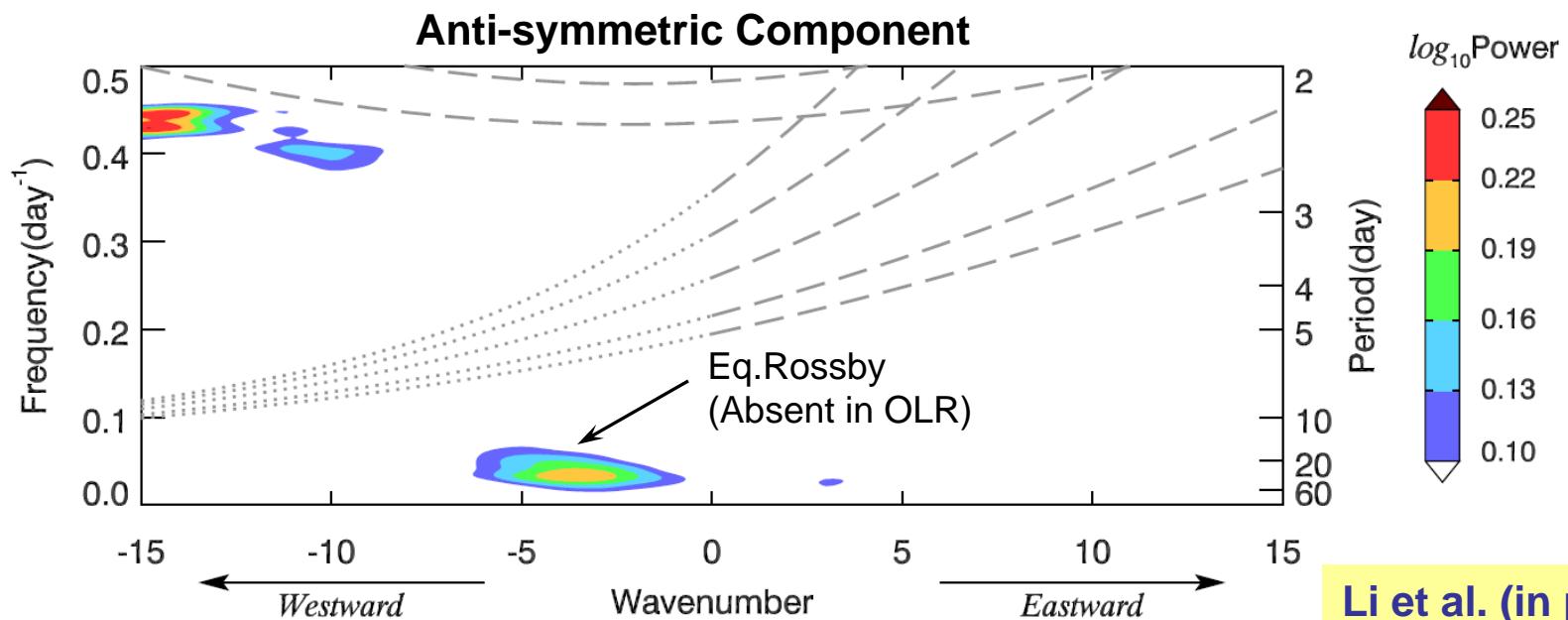
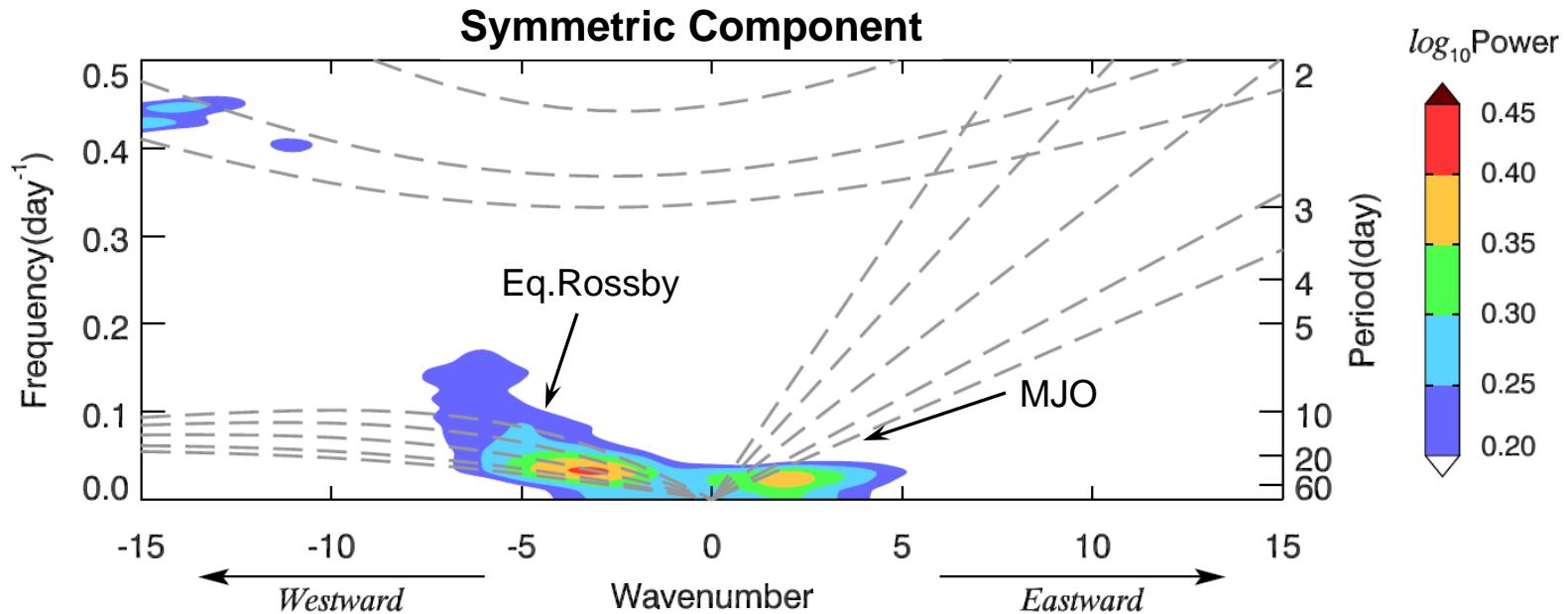


Mode Filtering: Equatorial Rossby mode

Wheeler-Hendon Averaged + Winters only

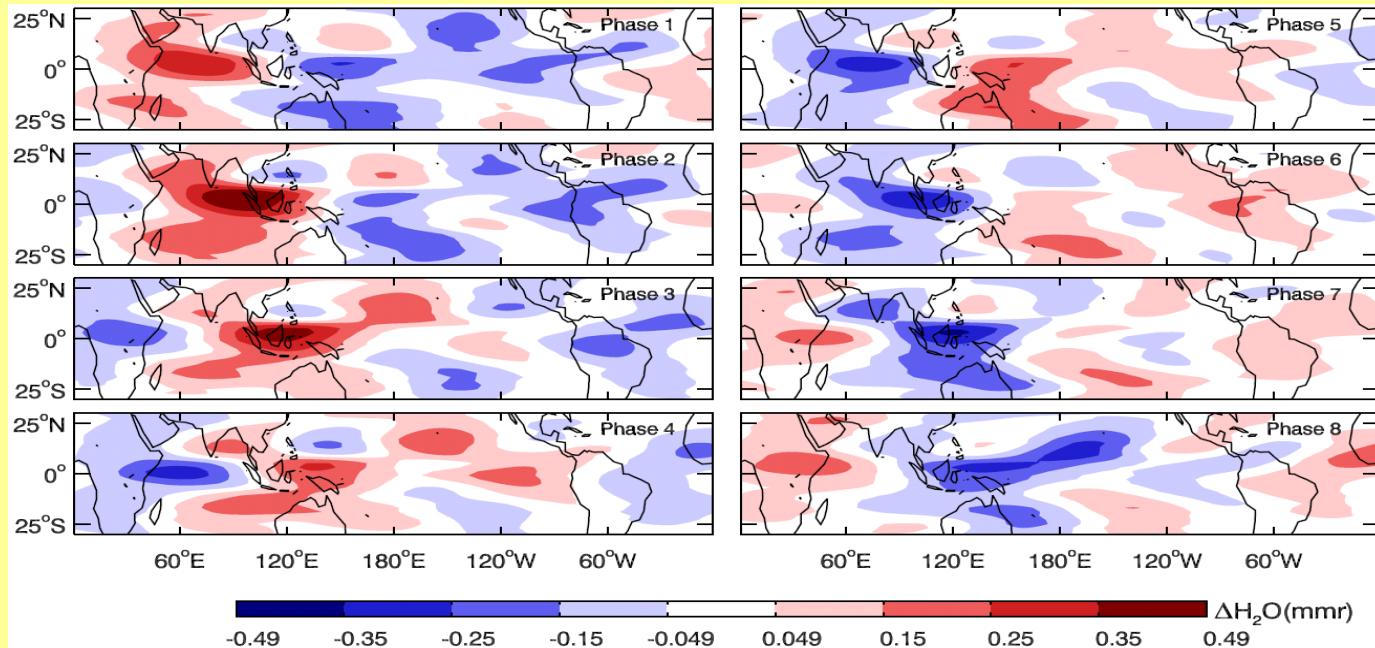


Spectral Analysis: AIRS H₂O (648 hPa)

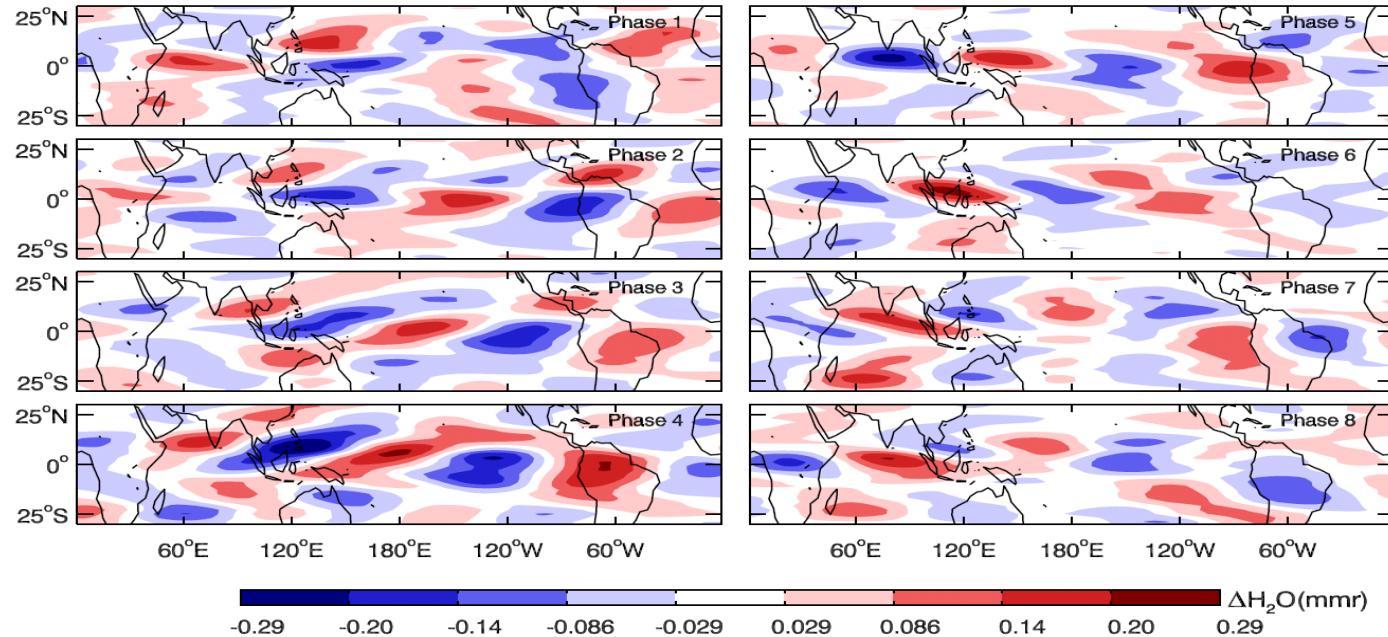


Filtered Modes

MJO Mode



Symmetric & Antisymmetric Rossby modes



Summary

- A significant part of the E Pacific mode can be explained by equatorial Rossby waves
- Possible Mechanisms:
 - Unobserved rising motions over E Pacific?
 - Boundary reflections by Andes? [Suggested by K. K. Tung]
- Useful data:
 - Assimilated vertical velocities from NCEP / ECMWF [How good are they in E Pacific?]
 - HDO [From TES / Scripps-IsoGSM / SCIAMACHY / AIRS?]